UCDS Based Stable Injector Design, Phase II

Completed Technology Project (2011 - 2013)

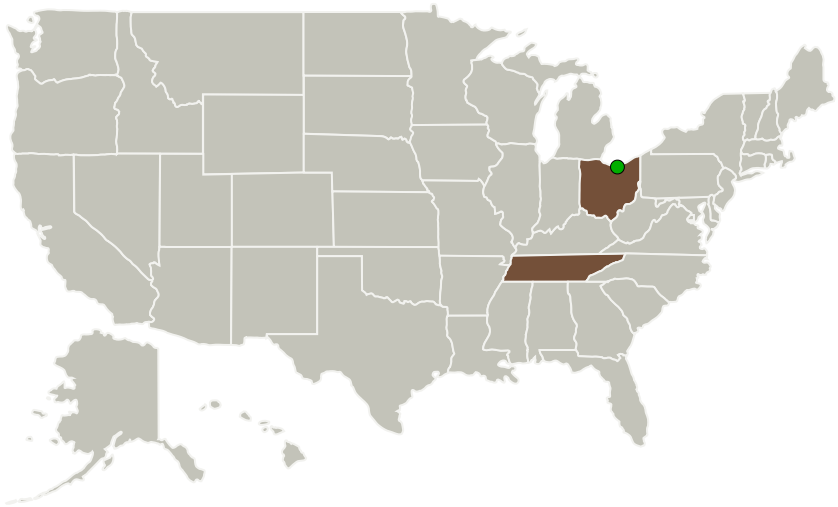
Project Introduction

History has repeatedly shown that combustion instability is the greatest technical risk faced in any chemical propulsion development program. The UCDS Process addresses this issue by using a rigorous physics-based analytical framework to decompose the complex flow field inside a chemical propulsion device, such as a liquid or solid rocket, in a way that allows rapid simulation of the dynamic behavior. Using UCDS it is possible to generate high fidelity predictions of the time evolution, amplitude and waveform of a pressure oscillation, along with any changes to the mean properties due to non-linear effects. Furthermore, it has been shown that the modal Alpha (linear growth rate) is a key physical parameter that defines the dynamic behavior of a rocket and provides a reliable measure of combustion stability margin. By monitoring how the array of modal Alphas change with design or operational features, the effects on engine combustion stability can be predicted. This insight provides the means to eliminate instability without resorting to expensive cut-and-try iterative developmental testing. GTL proposes to use this design guideline and the UCDS

TM

Process to create a clean-sheet design for a new liquid rocket that is inherently stable and compare it to an existing engine.

Primary U.S. Work Locations and Key Partners



UCDS Based Stable Injector Design, Phase II

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

UCDS Based Stable Injector Design, Phase II

Completed Technology Project (2011 - 2013)

Organizations Performing Work	Role	Type	Location
Gloyer-Taylor Laboratories LLC	Lead Organization	Industry	Tullahoma, Tennessee
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Tennessee

Project Transitions

June 2011: Project Start

August 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140071)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Gloyer-Taylor Laboratories LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Paul Gloyer

Co-Investigator:

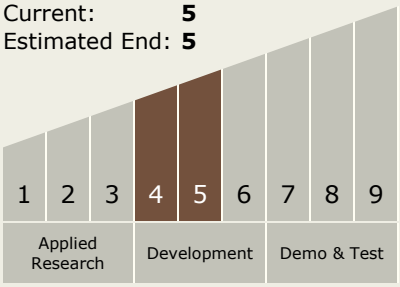
Paul Gloyer

UCDS Based Stable Injector Design, Phase II

Completed Technology Project (2011 - 2013)

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System